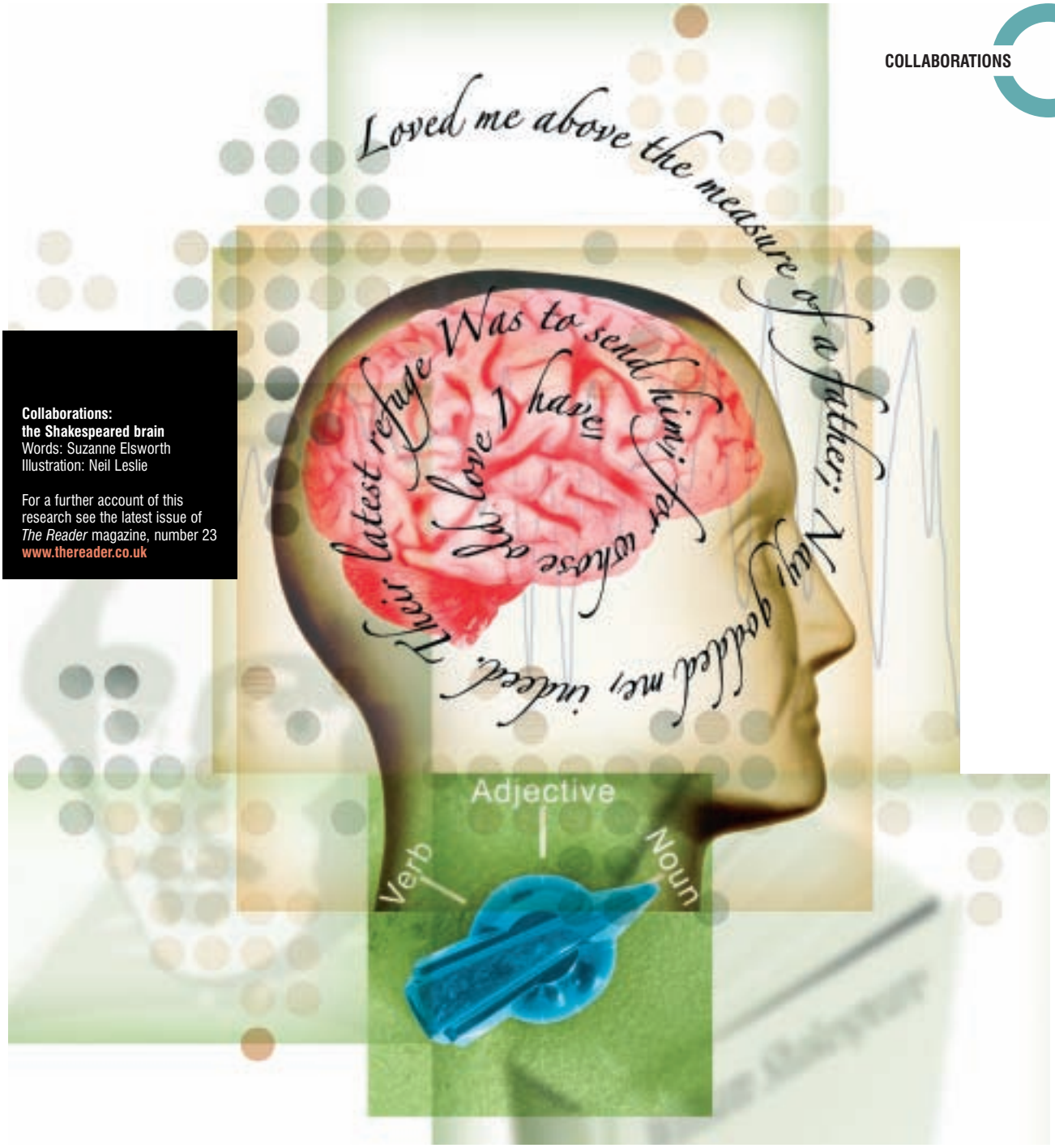

Collaborations:
the Shakespeared brain
Words: Suzanne Elsworth
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For a further account of this research see the latest issue of *The Reader* magazine, number 23
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the shakespeared brain

'THAT BOOK CHANGED MY LIFE' IS A COMMONPLACE, IF NOT OVERUSED, PHRASE BUT COULD IT BE THE CASE THAT A BOOK COULD CHANGE YOUR BRAIN?

"If you slot things into the brain's pigeonholes, it's boring. Confuse those pigeonholes and you get drama."

Professor Philip Davis
School of English

Collaborations: the Shakespeared brain
continued

Literary experts and scientists have joined forces to investigate the effect Shakespearian syntax has on neural pathways. They have discovered that the brain reaches heightened levels of function thanks to the Bard's unusually powerful use of words. Now more research is taking place to see if this increase in activity is acting as a work-out for the brain which could have lasting beneficial effects.

The initiative is the creation of Professor Philip Davis in the University's School of English who felt there was something special happening when certain phrases were read.

"I had a specific intuition about Shakespeare," he says. "I thought that the shapes of his lines and sentences somehow had a dramatic effect at deep levels in my mind. I have become interested not only in the contents of the thoughts I read and their meaning for me, but also in the very shapes and leaps that these thoughts take.

"Literature has always been dynamic to me and I dislike the taming of it, in terms of set ideas and agendas; but Shakespeare is extra-dynamic because the explosive language he uses somehow gets further inside us."

For example: Shakespeare uses a linguistic phenomenon known as functional shift or word-class conversion. This is where the writer uses one part of speech, such as a noun or an adjective, to serve as another, in many cases as a verb.

"Shakespeare shifts a word's grammatical nature with minimal alteration to its shape," says Philip. "Take, for example, the phrase 'he godded me', from the tragedy of *Coriolanus*. He's talking about what it's like to be treated like a god.

"The word 'godded' is unusual; it has changed a noun into a verb. But it is not just like paraphrasing, it's about a moment where the brain is surprised by what it is feeling. I am interested in the moment that creativity happens.

"The novel aspect of this research is that it provokes a positive mistake – the brain hesitates, but it is meant to do that. The brain is positively confused. It produces a burst of suddenly excited consciousness. Localised areas of the brain have to speak to each other: is this a noun? is it a verb? This produces a new level of live realisation. If you slot things into the brain's pigeonholes, it's boring. Confuse those pigeonholes and you get drama.

"It's not about tamed knowledge of Shakespeare or literature," he adds. "Something happens which confounds knowledge. Shakespeare changes word order, he crosses the line. His sentences use words which you are not used to, but you find you make sense of them, in a new burst of meaning."

Philip took his hypothesis about grammatical or linear shapes to a scientist, Professor Neil Roberts, who heads MARIARC, the Magnetic Resonance and Image Analysis Research Centre at the University of Liverpool, and Dr Guillaume Thierry, from the University of Wales, Bangor. They came up with experiments which tested this theory. With assistance from Dr Victorina Gonzalez-Diaz in the School of English, they designed 40 groups of text, each containing four sentences, one of which contained Shakespeare's functional shift.

For example:

a) I was not supposed to go there alone; you said you would accompany me.
b) I was not supposed to go there alone; you said you would incubate me.

Left:
MRI scans used in the experiment

c) I was not supposed to go there alone; you said you would charcoal me.
d) I was not supposed to go there alone; you said you would companion me.

The first of these sentences (accompany) is grammatically conventional, makes simple sense, and acts as a control for the experiment. The second (incubate) does not make semantic sense, while the third (charcoal) is both semantically and grammatically odd. The fourth is an example of Shakespeare's shift from noun to verb.

The team monitored subjects' brain activity as they completed the task. Initially they used EEG (electroencephalogram), with electrodes placed on various parts of the subjects' scalp, to measure when there was a reaction in the brain. After the EEG tests, MEG (magnetoencephalography) was used. This involves a helmet-like scanner which better measures effects in terms of their locations in the brain, as well as their timing. Finally, fMRI (functional magnetic resonance imaging) is now being used for more in-depth focus on locations within the brain.

"EEG gives graph-like measurements," said Guillaume. "When the brain senses a semantic violation, where the sentence doesn't seem to make sense, it registers what is called a N400 effect. This is a negative wave modulation 400 milliseconds after the onset of the word which is disrupting the meaning of the sentence.

"However, when the sentence is grammatically incorrect and the brain senses a syntactic violation, there is a P600 effect, a modulation peaking approximately 600 milliseconds after the critical word."

"Our preliminary results suggest this is the case with Shakespeare's use of words," adds Neil. "There is no P600 or N400 reaction to sentence A because it is correct both semantically and syntactically; however the dramatic opposite occurs with sentence C. With sentence B, there is no P600 as it makes grammatical sense, but there is a high N400 reaction as it does not make semantic sense. With the Shakespearian option D, there is a raised P600 as it feels like a grammatical anomaly, but no N400 as the brain will tolerate it as making sense, despite the grammatical difficulty."

Philip adds: "You begin to see that Shakespeare has produced a robust phenomenon. It's one of his intuitive working tools. It is as if he is making you forge the language anew every time."

Now, with the use of MEG and fMRI scanning, the team is trying to find out how long the heightened effect on the brain lasts, where it takes place – and whether it has lasting benefits.

"We don't know yet for how long after the key word the level of raised attention is sustained," says Philip, "and things get even more interesting long term. I think the more that people get used to this sudden deep response in the mind, the more flexible the brain is.

"It could stop mental rigidity, perhaps Alzheimer's, even more than Sudoku and the like. It's like a version of mental adrenaline. When you get to the key word there's no time to think – something is kicking in and making the mind alert. That's because the brain suddenly explores a stranger verbal environment."